Topic: Midpoint of a line segment in three dimensions

Question: Find the midpoint of the line segment joining P_1 and P_2, where

$$P_1 = (2,7,5)$$

$$P_2 = (4,1,1)$$

Answer choices:

A $(-1,3,2)$

B $(6,8,6)$

C $(2,7,0)$

D $(3,4,3)$

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Solution: D

We'll use the midpoint segment formula

$$m = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2}\right)$$

and plug in the points we've been given. We'll use $P_1 = (2,7,5)$ for (x_1, y_1, z_1) and $P_2 = (4,1,1)$ for (x_2, y_2, z_2).

$$m = \left(\frac{2+4}{2}, \frac{7+1}{2}, \frac{5+1}{2}\right)$$

$$m = \left(\frac{6}{2}, \frac{8}{2}, \frac{6}{2}\right)$$

$$m = (3,4,3)$$

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Topic: Midpoint of a line segment in three dimensions

Question: Find the midpoint of the line segment joining P_1 and P_2, where

$$P_1 = (4, -3, -1)$$

$$P_2 = (3{,}5, -7)$$

Answer choices:

A $(3.5{,}1, -4)$

B $(3.5{,}4, -4)$

C $(1{,}4{,}4)$

D $(4{,}0{,}9)$

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Solution: A

We'll use the midpoint segment formula

$$m = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2}\right)$$

and plug in the points we've been given. We'll use $P_1 = (4, -3, -1)$ for (x_1, y_1, z_1) and $P_2 = (3{,}5, -7)$ for (x_2, y_2, z_2).

$$m = \left(\frac{4+3}{2}, \frac{-3+5}{2}, \frac{-1+(-7)}{2}\right)$$

$$m = \left(\frac{7}{2}, \frac{2}{2}, \frac{-8}{2}\right)$$

$$m = (3.5, 1, -4)$$

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Topic: Midpoint of a line segment in three dimensions

Question: Find the endpoint of the line segment.

The segment joining P_1 and P_2, with midpoint m, where

$$P_1 = (6{,}5, -3)$$

$$m = (4, -4, -5)$$

Answer choices:

A $\left(5, \frac{1}{2}, -4\right)$

B $(1, -4.5, -1)$

C $(2, -13, -7)$

D $(-3,6,5)$

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Solution: C

We'll use the midpoint segment formula

$$m = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2}\right)$$

and plug in the points we've been given. We'll use $P_1 = (6{,}5, -3)$ for (x_1, y_1, z_1) and $m = (4, -4, -5)$ for m.

$$(4, -4, -5) = \left(\frac{6 + x_2}{2}, \frac{5 + y_2}{2}, \frac{-3 + z_2}{2}\right)$$

Then we'll create separate equations for x, y, and z.

For x:

$$4 = \frac{6 + x_2}{2}$$

$$8 = 6 + x_2$$

$$x_2 = 2$$

For y:

$$-4 = \frac{5 + y_2}{2}$$

$$-8 = 5 + y_2$$

$$y_2 = -13$$

For z:

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$$-5 = \frac{-3 + z_2}{2}$$

$$-10 = -3 + z_2$$

$$z_2 = -7$$

Putting these values together, we can say that the endpoint of the line segment is

$$(2, -13, -7)$$

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